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#### NEW DAILY WEATHER MAP.

The daily weather map of the Northern Hemisphere now being published by the United States Weather Bureau, is likely to become invaluable to all who are actively interested in the study of the free atmosphere, as distinguished from the study of the air near the earth's surface that directly belongs to agriculture and climatology.

The edition presents both the second edition of the regular 8 a. m. map of the United States and, on the reverse, the daily map of the Northern Hemisphere. It is limited to a few hundred copies and is sent to libraries, meteorological offices, and a few special meteorological students. Copies are dispatched either daily (folded), or in weekly rolls, or in monthly rolls, by mail or through the International Exchange Service of the Smithsonian Institution, according as requested by the respective recipients. Copies are also to be purchased through the United States superintendent of public documents at \$3 per year or 30 cents per month. The following letter accompanied the first issue:

#### WEATHER MAP OF THE NORTHERN HEMISPHERE.

On January 1, 1914, the United States Weather Bureau began the publication at Washington of a weather map of the Northern Hemisphere, a copy of which accompanies this announcement. Hereafter this map will be printed on the reverse side of the morning weather map of the United States. A similar manuscript map of the Northern Hemisphere has been prepared daily for several past years in the Weather Bureau, and has proved of great value to the forecasters in predicting general changes of the weather, and especially in extending the periods for which such forecasts can be successfully made. Although the number of reports available for the construction of the map is limited at present, and the times of observation are not all strictly simultaneous, nevertheless the essential features of the atmospheric circulation over the Northern Hemisphere are fairly well depicted.

In beginning this important publication it seemed advisable not to retain the arbitrary and irrational units ordinarily employed for measuring pressure and temperature of the atmosphere, but to adopt the more scientific and rational units of the C. G. S. system. Accordingly, the reported pressures are all expressed in dynamic units in which a pressure of 750.06 mm. of mercury corresponds to a force of 1,000,000 dynes. Following the suggestion of Bjerknes, this absolute unit of pressure is called 1 bar=1,000 millibars. The reported temperatures have all been reduced to the absolute scale (Centigrade) on which the temperature of melting ice is 273°.

Mathematical and dynamic studies of the motions of the atmosphere are possible only when the data are given in rational units of the kind described. It is hoped the publication of this map of the Northern Hemisphere will facilitate and promote the serious scientific study of the great and complex problems of the general circulation of the atmosphere.

C. F. MARVIN, *Chief of Bureau.*

This new daily weather map of the Northern Hemisphere has received general commendation both in Europe and America. The world's progress in telegraphy has thus made possible this modification of the ideas carried out by Gen. A. J. Myer in 1872 in his "International Bulletin of Simultaneous Meteorological Observations." That bulletin was dropped in 1889 by the Chief Signal Officer, presumably because of expense. It was revived in different form as a part of the marine meteorological work of this bureau in 1894; its map has been maintained in manuscript as a part of the forecast work since 1895. Prof. C. F. Marvin has returned to the original polar projection (Postel-Werner) and the map is now published daily by lithography as nearly as possible in agreement with the ideas of all prominent students of the free atmosphere. We quote a few acknowledgments:

Bjerknes, Leipzig, January 29, 1914:

I have been pleased to see the publication of your daily weather map for the Northern Hemisphere. The introduction of the C. G. S. units is a very great progress indeed.

Gold, London:

I must write to congratulate you on the energetic way in which you have tackled the question of units and on the beautiful Northern Hemisphere charts in millibars and absolute degrees, of which you have sent me a copy. \* \* \* You will probably see that absolute units have also been used from January 1 for the daily charts which are issued with the Weekly Weather Report.

Hergesell, Strassburg:

I have received with much interest the first weather map of the Northern Hemisphere. \* \* \* Precisely in the work of the International Commission for Scientific Aeronautics, this map will be a great help and a great advantage. I believe that all problems of general meteorology, which embrace, not local studies but the great problems of the general circulation, will receive a great encouragement from this publication.

Wilfred M. Wilson, Ithaca, N. Y., professor of meteorology:

I beg to offer my congratulations on this important advance which, I feel sure, will tend toward the realization of the hope expressed in the last paragraph of your memorandum, as to the "serious scientific study of the great and complex problems of the general circulation of the atmosphere."

Charles Stewart, Spokane, Wash., local forecaster:

The map of the Northern Hemisphere supplies a long-felt want. It is of great value for forecast studies and its daily publication will be gladly welcomed.

Dr. W. Köppen, Hamburg, January 22, 1914:

With great interest and delight I have to-day received the new daily weather map for January 1, 1914, with the weather map of the Northern Hemisphere. The transition to the millibars was a delightful surprise. In reference to the isotherms I would urge that they be drawn for the absolute temperatures 268°, 273°, 278°, 283°, etc., instead of for 270°, 275°, etc.

It is also desirable to accentuate the isotherm of 273° by a thicker line in order to bring the frost region of winter into prominence.

**Wm. Marriott**, secretary, Royal Meteorological Society, London, January 23, 1914:

The publication of such a map is a great advance in meteorology and will help us to understand better many of the problems of the general circulation of the atmosphere.

**R. Siedek**, Central Hydrographic Office, Vienna, January 29, 1914:

The K. k. hydrographische Zentral Bureau most heartily welcomes the new daily weather map of the Northern Hemisphere, published by the United States Weather Bureau.

**W. H. Hammon**, formerly district forecaster at San Francisco:

I have your new map of the Northern Hemisphere on the reverse side of the morning weather map. I think this is the most valuable scientific step taken by the Weather Bureau in many years, and I believe very valuable results will ensue. \* \* \* When I was in California I made a series of daily weather maps of the Pacific Ocean from the hydrographic reports and drew the best lines I could. I believe this information was extremely valuable in perfecting the system of forecasts which we followed in California. This series of maps was among the serious losses that resulted from the San Francisco fire [April, 1906].

**C. Hart Merriam**, executive of the "Harriman Trust Fund":

Your new departure in printing the Northern Hemisphere weather map on the back of the United States weather map is a great advance, and I congratulate you on having brought this about.

**Prof. Ellsworth Huntington**, Yale University:

The idea of giving a general map of the entire Northern Hemisphere is extremely useful. \* \* \* For the nonscientific man who is interested in the weather they are sure to prove educational. \* \* \*

**Prof. Dr. Felix Exner**, K. k. Universität Innsbruck, March 4, 1914:

\* \* \* A copy of the International Map for the Northern Hemisphere for January 1, 1914, has come to my Institute, and I admired very much this great progress in weather maps.

#### THE WEATHER MAP ON THE POLAR PROJECTION.

One can not examine a series of the new daily weather maps of the Northern Hemisphere without realizing that this publication is destined to throw great light on the motions of our atmosphere and on the periodic as well as the quasi-periodic and the irregular changes of our weather and storms. Especially does it renew that stimulus to the study of the mechanics of the earth's atmosphere, which was first given by the memoirs of William Ferrel. His study of 1858-1860, which he began in 1856 as a popular essay, was reprinted as Professional Paper of the U. S. Signal Service, No. 8, Washington, 1882, with notes by Prof. Frank Waldo. This, together with his many other studies, will always command our admiration, no matter what advances may hereafter be made in the mathematical treatment of atmospheric motions. Ferrel taught us that the diurnal rotation of the earth on its axis, the attraction of gravitation, and the distribution of temperature near the earth's surface, are the three fundamental factors that must be considered. Subsequently he discussed the differences of friction over land and water; the thermodynamics of ascending and descending masses of air; the influence of the distribution of moisture; finally, toward the close of his life, he began the consideration of the influences of radiation and absorption.

So far as we know no one has as yet dared to begin the discussion of the motions of the atmosphere under the combined influences of all these seven factors and yet these must be gathered into one set of systematic equa-

tions or graphic charts, if we would fully understand the phenomena shown by the daily weather map. In fact, an eighth factor must be added, viz, the influence of high plateaus and mountain ranges as superadded to the influences of the lower continental surfaces. Eventually we may consider the ninth factor, viz, the influence of viscosity. When we consider the simple hypothetical atmosphere treated of at first by Ferrel, we perceive that the denser portions of the air are thrown toward the Equator by the diurnal centrifugal force, but that there must be a return current toward the pole of the warmer lighter air, thus giving rise to currents and whirls which become either cyclonic or anticyclonic since the attraction of gravitation holds the atmosphere near the surface of a rotating spheroid. These whirls give rise to the areas of high pressure and low pressure of which we usually see from three to a dozen dotting the map of the Northern Hemisphere. Usually we may consider the air flowing toward the pole as warmer, lighter, and rising, while that flowing toward the Equator is colder, drier and descending. Innumerable obstacles start smaller whirls that are scarcely noticed among these general features.

Our polar map of the Northern Hemisphere shows at a glance that our storms and our blizzards, our hot areas and our hurricanes, are due to the interchanges of air between the Torrid Zone and the Arctic region. A dozen such centers of action are sufficient to enable the atmospheres of northern and southern latitudes to maintain steady interchanges of position without any violent actions, just as earthquakes and minor fractures produce minor earthquakes that save our globe from any extreme cataclysms. For instance, some portion of the atmosphere over the North Polar region, being cooled by atmospheric and terrestrial radiations as also by the expansion of moist air against atmospheric pressure, deposits much of its moisture as rain or snow, becomes relatively denser, and is then pushed southward. There is a resulting region of low pressure about which the winds circulate. This area is sometimes nearly circular and at other times much elongated. The elongated trough may extend from Norway to northern Siberia, or from Newfoundland to Norway, or from the north of Alaska to Labrador. In fact, this trough must oscillate all over the Arctic region from day to day and month to month, in a quasi-periodic fashion depending on the sum total of the moments of inertia of the whole atmosphere relative to our polar axis. Our polar and equatorial winds circulate around this trough, and our large storm centers circulate with it around the pole. Hence these storm centers may come upon the United States most unexpectedly from the northwest or southwest, or from the south or southeast. The map of the United States between latitudes 30° and 50° only, gives us no indication of the causes of these irregularities, whereas the map of our whole hemisphere shows at once that they represent whirls in an atmosphere that thereby attempts to maintain a dynamic equilibrium in each hemisphere. It is the excess of continental resistances obtaining in the northern hemisphere over the southern that allows of the interchange of circulations between it and the southern one. It would be utterly wrong to study our moving atmosphere as a problem in statics. A slight disturbance of static equilibrium produces a complete upset of the dynamic equilibrium and from that moment its readjustment becomes the dominating feature of the atmosphere.

Static equilibrium has never existed throughout the atmosphere of our globe. It is only approximated over comparatively small regions, and for short intervals of time. As to dynamic equilibrium Helmholtz has shown